INTRODUCTORY AND BACKGROUND SECTIONS

Chapter 1: **Executive Summary-PLACEHOLDER**

Chapter 2: Introduction

Regulatory history

Greater Sage-Grouse

On July 2, 2002, we received a petition from Craig C. Dremann requesting that we list the greater sage-grouse (*Centrocercus urophasianus*; hereafter sage-grouse) as endangered across its entire range. We received a second petition from the Institute for Wildlife Protection on March 24, 2003, requesting that the sage-grouse be listed rangewide. On December 29, 2003, we received a third petition from the American Lands Alliance and 20 additional conservation organizations to list the sage-grouse as threatened or endangered rangewide. On April 21, 2004, we announced our 90–day petition finding in the Federal Register (69 FR 21484) that these petitions taken collectively, as well as information in our files, presented substantial information indicating that the petitioned actions may be warranted. On July 9, 2004, we published a notice to reopen the period for submitting comments on our 90–day finding, until July 30, 2004 (69 FR 41445). In accordance with section 4(b)(3)(A) of the Act, we completed a status review of the best available scientific and commercial information on the species. On January 12, 2005, we announced our not-warranted 12–month finding in the Federal Register (70 FR 2243).

On July 14, 2006, Western Watersheds Project filed a complaint in Federal district court alleging that the Service's 2005 12–month finding was incorrect and arbitrary and requested the finding be remanded to the Service. On December 4, 2007, the U.S. District Court of Idaho ruled that our 2005 finding was arbitrary and capricious, and remanded it to the Service for further consideration. On January 30, 2008, the court approved a stipulated agreement between the Department of Justice and the plaintiffs to issue a new finding in May 2009, contingent on the availability of a new monograph of information on the sage-grouse and its habitat (Monograph). On February 26, 2008, we published a notice to initiate a status review for the sage-grouse (73 FR 10218), and on April 29, 2008, we published a notice extending the request for submitting information to June 27, 2008 (73 FR 23172). Publication of the Monograph was delayed due to circumstances outside the control of the Service. An

amended joint stipulation, adopted by the court on June 15, 2009, required the Service to submit the 12–month finding to the Federal Register by February 26, 2010; this due date was subsequently extended to March 5, 2010.

We delivered a 12-month finding to the Federal Register by this due date, and it was published on March 23, 2010 (75 FR 13910). The 12-month finding announced that listing the sage-grouse rangewide was warranted, but precluded by higher priority listing actions, and the species was added to the list of candidate species with a listing priority number of 8. As required by section 4(b)(3)(C) of the Act, we have subsequently made annual resubmitted petition findings, announced in conjunction with our Candidate Notices of Review, in which we continued to find that listing the sage-grouse rangewide was warranted but precluded by other higher priority listing actions (75 FR 69222, 76 FR 66370, 77 FR 69994, 78 FR 70104, 79 FR 72450).

On May 10, 2011, we filed a multiyear work plan as part of a proposed settlement agreement with Wild Earth Guardians and others in a consolidated case in the U.S. District Court for the District of Columbia. On September 9, 2011, the Court accepted our agreement with the plaintiffs in Endangered Species Act Section 4 Deadline Litig., Misc. Action No. 10–377 (EGS), MDL Docket No. 2165 (D. DC) (known as the ''MDL case'') on a schedule to publish proposed rules or not-warranted findings for the 251 species designated as candidates as of 2010 no later than September 30, 2016. The work plan included a deadline to submit a proposed rule or a not-warranted finding to the Federal Register for sage-grouse, including any Distinct Population Segments (DPSs), by the end of FY 2015.

Comment [Craig1]: Rider?

Western Subspecies of the Greater Sage-Grouse

The western subspecies of the greater sage-grouse (*Centrocercus urophasianus phaios*) was identified by the Service as a category 2 candidate species on September 18, 1985 (50 FR 37958). At the time, we defined Category 2 species as those species for which we possessed information indicating that a proposal to list as endangered or threatened was possibly appropriate, but for which conclusive data on biological vulnerability and threats were not available to support a proposed rule. On February 28, 1996, we discontinued the designation of

category 2 species as candidates for listing under the Act (61 FR 7596), and consequently the western subspecies was no longer considered to be a candidate for listing.

We received a petition, dated January 24, 2002, from the Institute for Wildlife Protection requesting that the western subspecies occurring from northern California through Oregon and Washington, as well as any western sage-grouse still occurring in parts of Idaho, be listed under the Act. The petitioner excluded the Mono Basin area populations in California and northwest Nevada since they already had petitioned this population as a DPS for emergency listing (see discussion of Bi-State area (Mono Basin) population below). The petitioner also requested that the Service include the Columbia Basin DPS in this petition, even though we had already identified this DPS as a candidate for listing under the Act (66 FR 22984, May 7, 2001) (see discussion of Columbia Basin below).

We published a 90–day finding on February 7, 2003 (68 FR 6500), that the petition did not present substantial information indicating the petitioned action was warranted based on our determination that there was insufficient evidence to indicate that the petitioned western population of sage-grouse is a valid subspecies or DPS. The petitioner pursued legal action, first with a 60–day Notice of Intent to sue, followed by filing a complaint in Federal district court on June 6, 2003, challenging the merits of our 90–day finding. On August 10, 2004, the U.S. District Court for the Western District of Washington ruled in favor of the Service (Case No. C03-1251P). The petitioner appealed and on March 3, 2006, the U.S. Court of Appeals for the Ninth Circuit reversed in part the ruling of the District Court and remanded the matter for a new 90–day finding (Institute for Wildlife Protection v. Norton, 2006 U.S. App. LEXIS 5428 9th Cir., March 3, 2006). Specifically, the Court of Appeals rejected the Service's conclusion that the petition did not present substantial information indicating that western sage-grouse may be a valid subspecies, but upheld the Service's determination that the petition did not present substantial information indicating that the petitioned population may constitute a DPS. The Court's primary concern was that the Service did not provide a sufficient description of the principles we employed to determine the validity of the subspecies classification. On April 29, 2008, we published in the Federal Register (73 FR 23170) a 90–day finding that the petition presented substantial scientific or commercial information indicating that listing western sage-grouse may be warranted and initiated a status review for western sage-grouse.

Subsequently, in our March 23, 2010 12-month finding (75 FR 13910), we announced that listing the western subspecies of the sage-grouse was not warranted, based on our determination that the western subspecies is not a valid taxon and thus not a listable entity under the Act. We noted, however, that sage-grouse in the area covered by the putative western subspecies (except those in the Bi-State area, covered by a separate finding), were encompassed by our finding that listing the species rangewide was warranted but precluded.

In a related action, the Service also has made a finding on a petition to list the eastern subspecies of the greater sage-grouse (*Centrocercus urophasianus urophasianus*). On July 3, 2002, we received a petition from the Institute for Wildlife Protection to list the eastern subspecies, identified in the petition as including all sage-grouse east of Oregon, Washington, northern California, and a small portion of Idaho. The petitioners sued the Service in U.S. District Court on January 10, 2003, for failure to complete a 90–day finding. On October 3, 2003, the Court ordered the Service to complete a finding. The Service published its not-substantial 90–day finding in the Federal Register on January 7, 2004 (69 FR 933), based on our determination that the eastern sage-grouse was not a valid subspecies. The not-substantial finding was challenged, and on September 28, 2004, the U.S. District Court ruled in favor of the Service, dismissing the plaintiff's case.

Columbia Basin (Washington) Population of the Western Subspecies

On May 28, 1999, we received a petition dated May 14, 1999, from the Northwest Ecosystem Alliance and the Biodiversity Legal Foundation. The petitioners requested that the Washington population of western sage-grouse (C. u. phaios) be listed as threatened or endangered under the Act. The petitioners requested listing of the Washington population of western sage-grouse based upon threats to the population and its isolation from the remainder of the taxon. Accompanying the petition was information relating to the taxonomy, ecology, threats, and the past and present distribution of western sage-grouse.

In our documents we have used ''Columbia Basin population'' rather than ''Washington population'' because we believe it more appropriately describes the petitioned entity. We published a substantial 90–day finding on August 24, 2000 (65 FR 51578). On May 7, 2001, we published our 12–month finding (66 FR 22984), which

included our determination that the Columbia Basin population of the western sage-grouse met the requirements of our policy on DPSs (61 FR 4722) and that listing the DPS was warranted but precluded by other higher priority listing actions. As required by section 4(b)(3)(C) of the Act, we have subsequently made annual resubmitted petition findings, announced in conjunction with our Candidate Notices of Review, in which we continued to find that listing the Columbia Basin DPS of the western subspecies was warranted but precluded by other higher priority listing actions (66 FR 54811, 67 FR 40663, 69 FR 24887, 70 FR 24893, 74 FR 57803, 75 FR 69222, 76 FR 66370, 77 FR 69994, 78 FR 70104, 79 FR 72450).

Subsequent to the March 2006 decision by the court on our 90–day finding on the petition to list the western subspecies of the sage-grouse (described above), our resubmitted petition findings stated we were not updating our analysis for the DPS, but would publish an updated finding regarding the petition to list the Columbia Basin population of the western subspecies following completion of the new rangewide status review for the sage-grouse. Subsequently, in light of the conclusions in our March 2010 12-month finding regarding the invalidity of the western sage-grouse subspecies (the taxonomic entity we relied on in our DPS analysis for the Columbia Basin population), our resubmitted petition findings stated that the significance of the Columbia Basin DPS to the sage-grouse would require further review. We stated that we intended to complete an analysis to determine if this population continues to warrant recognition as a DPS in accordance with our Policy Regarding the Recognition of Distinct Vertebrate Population Segments (61 FR 4722; February 7, 1996) at the time we make a listing decision on the status of the sage-grouse. Until that time, the Columbia Basin DPS has remained a candidate for listing as a separate population of sage-grouse.

Bi-State Area (Mono Basin) Population of Sage-grouse

On January 2, 2002, we received a petition from the Institute for Wildlife Protection requesting that the sage-grouse occurring in the Mono Basin area of Mono County, California, and Lyon County, Nevada, be emergency listed as an endangered DPS of *Centrocercus urophasianus* phaios, which the petitioners considered to be the western subspecies of the greater sage-grouse. This request was for portions of Alpine and Inyo Counties and most of Mono County in California and portions of Carson City, Douglas, Esmeralda, Lyon, and Mineral

Counties in Nevada. On December 26, 2002, we published a 90–day finding that the petition did not present substantial scientific or commercial information indicating that the petitioned action may be warranted (67 FR 78811). Our 2002 finding was based on our determination that the petition did not present substantial information indicating that the population of sage-grouse in this area was a DPS under our DPS policy (61 FR 4722; February 7, 1996), and thus was not a listable entity (67 FR 78811; December 26, 2002). Our 2002 finding also included a determination that the petition did not present substantial information regarding threats to indicate that listing the petitioned population may be warranted (67 FR 78811).

On November 15, 2005, we received a petition submitted by the Stanford Law School Environmental Law Clinic on behalf of the Sagebrush Sea Campaign, Western Watersheds Project, Center for Biological Diversity, and Christians Caring for Creation to list the Mono Basin area population of sage-grouse as a threatened or endangered DPS of the sage-grouse under the Act. On March 28, 2006, we responded that emergency listing was not warranted and, due to court orders and settlement agreements for other listing actions, we would not be able to address the petition at that time.

On November 18, 2005, the Institute for Wildlife Protection and Dr. Steven G. Herman sued the Service in U.S. District Court for the Western District of Washington (Institute for Wildlife Protection et al. v. Norton et al., No. C05-1939 RSM), challenging the Service's 2002 finding that their petition did not present substantial information indicating that the petitioned action may be warranted. On April 11, 2006, we reached a stipulated settlement agreement with both plaintiffs under which we agreed to evaluate the November 2005 petition and concurrently reevaluate the December 2001 petition (received in January 2002). The settlement agreement required the Service to submit to the Federal Register a 90–day finding by December 8, 2006, and if substantial, to complete the 12–month finding by December 10, 2007. On December 19, 2006, we published a 90–day finding that these petitions did not present substantial scientific or commercial information indicating that the petitioned actions may be warranted (71 FR 76058).

On August 23, 2007, the November 2005 petitioners filed a complaint challenging the Service's 2006 finding. After review of the complaint, the Service determined that we would revisit our 2006 finding. The Service entered into a settlement agreement with the petitioners on February 25, 2008, in which the Service agreed to a voluntary remand of the 2006 petition finding, and to submit for publication in the Federal Register a new 90–day finding by April 25, 2008. The agreement further stipulated that if the new 90–day finding was positive, the Service would undertake a status review of the Mono Basin area population of the sage-grouse and submit for publication in the Federal Register a 12–month finding by April 24, 2009.

On April 29, 2008, we published in the Federal Register (73 FR 23173) a 90–day petition finding that the petitions presented substantial scientific or commercial information indicating that listing the Mono Basin area population may be warranted and initiated a status review. Based on a joint stipulation by the Service and the plaintiffs to extend the due date for the 12–month finding, on April 23, 2009, the U.S. District Court, Northern District of California, issued an order that if the parties did not agree to a later alternative date, the Service would submit a 12–month finding for the Mono Basin population of the sage-grouse to the Federal Register no later than May 26, 2009. On May 27, 2009, the U.S. District Court, Northern District of California, issued an order accepting a joint stipulation between the Department of Justice and the plaintiffs, which stated that the parties agree that the Service may submit to the Federal Register a single document containing the 12–month findings for the Mono Basin area population and the sage-grouse no later than by February 26, 2010. The due date for submission of the document to the Federal Register was extended to March 5, 2010, and after we submitted the document to the Federal Register by this date, the document was subsequently published on March 23, 2010 (75 FR 13910), in a combined finding that also considered sage-grouse rangewide, as discussed above. In this document, we concluded, among other things, that the Mono Basin area population is a listable entity under Service policy as a DPS and that the DPS warranted protection under the Act but that immediate action was precluded by higher listing priorities. This warranted-but- precluded finding placed the DPS on our candidate list.

Both the 2002 and 2005 petitions, as well as our 2002 and 2006 findings, use the term ''Mono Basin area'' and ''Mono Basin population'' to refer to sage-grouse that occur within the geographic area of eastern California and

western Nevada that includes Mono Lake. For conservation planning purposes, this same geographic area is referred to as the Bi-State area by the States of California and Nevada. For consistency with ongoing planning efforts, we adopted the ‘‘Bi-State’’ nomenclature in our 2010 finding and consequently have referred to this DPS as the ‘‘Bi-State DPS’’ within subsequent documents.

As required by section 4(b)(3)(C) of the Act, we subsequently made annual resubmitted petition findings, announced in conjunction with our Candidate Notices of Review, in which we continued to find that listing the Bi-State DPS was warranted but precluded by other higher priority listing actions (75 FR 69222, 76 FR 66370, 77 FR 69994). On May 10, 2011, we filed a multiyear work plan as part of a proposed settlement agreement with Wild Earth Guardians and others in a consolidated case in the U.S. District Court for the District of Columbia. On September 9, 2011, the Court accepted our agreement with the plaintiffs in the MDL case (as described above) on a schedule to publish proposed rules or not-warranted findings for the 251 species designated as candidates as of 2010 no later than September 30, 2016.

In compliance with our MDL work plan, on October 28, 2013, we published a proposed rule to list the Bi-State DPS of sage-grouse as threatened under the Act and establish a 4(d) special rule (78 FR 64358), and a proposed rule to designate critical habitat for the Bi-State DPS (78 FR 64328).

Process for 2015 status review

As described above, the Service must evaluate the status and submit a proposed rule or a not-warranted finding to the Federal Register for sage-grouse, including the Columbia Basin population, by September 2015. Since the 2010 finding that sage-grouse warranted Federal protection under the Act, but was precluded by higher priority actions, considerable progress has been made to address the threats and provide additional information regarding the species. In this status review, the Service will evaluate the best available scientific and commercial information to determine whether the species is in danger of extinction or is likely to become endangered in the foreseeable future throughout all or a significant portion of its range.

Comment [SB2]: Drawn heavily from the Process Analytical Framework document.

Per Jesse’s comment, I am flagging this to be potentially updated at a later time, since the process seems to keep evolving!

Comment [Craig3]: Tense?

We are committed to building the most transparent, thorough, and scientifically defensible status review in the agency's history. We intend to achieve this goal by incorporating the robust modeling efforts of our partners, requesting information on the ongoing and future conservation efforts, and working with the states to understand the current status of the sage-grouse. The information available on sage-grouse comprises a huge amount of data; we will structure our analysis to best utilize the available information.

Comment [Craig4]: Tense?

The Service relies on a number of foundational elements for our status assessment, primarily the language of the Act, its implementing regulations, and agency policy, as well as previous work and assessments of the species' status, including the 2010 finding, and the Greater Sage-Grouse Conservation Objectives (COT) Report (FWS 2013, entire). The principle factors leading to the 2010 warranted but precluded finding were habitat loss and fragmentation, principally due to invasive species and fire, energy development and associated infrastructure, sagebrush conversion due to agricultural practices, and a lack of adequate regulatory mechanisms to address those threats. These threats will be a focus of the analysis we are conducting for the current species status review. The final COT report, a product of state and Federal collaboration, outlined the key areas for conservation of the species, the key threats in those areas, and conservation objectives involving reduction of those threats. The COT report identified the most important areas needed for long-term persistence of the species, which were termed Priority Areas for Conservation (PACs). The COT report has served as the basis for our technical advice regarding current regulatory and voluntary planning efforts and is a lens through which we are analyzing conservation measures during this status review.

In this review, the Service will apply the statute, regulations, and appropriate policies in the context of previous decisions for sage-grouse and other similar species that we have evaluated under the Act, and we will explain meaningful differences based on species, threat impacts, or scale. We will use a structured analytical framework and process to assess the scientific, commercial, and legal information we must consider when making a listing decision.

A foundational element of our analysis is a current understanding of the status of the species, against which we will evaluate the impacts of threats and beneficial actions. We have worked with states and other partners to gather the most recent information to understand the current status and trend of the species at various spatial scales, including across the remainder of the range. The Service will assess all of the best available scientific and commercial information about the sage-grouse, the species' habitat needs, and potential impacts. We will address any new information and explain how our understanding of available scientific information may or may not have changed since the 2010 finding.

The sage-grouse's expansive range makes the evaluation of population, habitat, threats, and conservation efforts in a geospatial context a preferred option for assessing information. We have conducted all spatial analyses to predict indices of distribution and relative abundance of sage-grouse where possible. Our base spatial level of analysis is the PACs; our analyses are scale-able to populations, other potential areas of interest, and the remainder of the range.

In this species report, we assess the degree to which the major threats of habitat loss and fragmentation and inadequacy of regulatory mechanisms have been addressed since 2010. We also evaluate any new threats to the species. For each of the major threats identified from 2010 finding and in the COT report and any significant new threats identified, we assess their impacts to both relative abundance and distribution of sage-grouse at multiple spatial scales.

Just as we attempt to quantify threats and predict their impacts, we also attempt in this species report to quantify the degree to which state and Federal plans, and local and other conservation efforts have already ameliorated threats to sage-grouse or are likely to do so into the future. We seek to understand how state and Federal plans, local conservation efforts, and other conservation efforts put in place since 2010 have removed or reduced impacts from threats, particularly within PACs. Management direction described in recently revised or amended Federal Land Management Plans is evaluated under Factor D based upon the likelihood of effectiveness in ameliorating known threats to sage-grouse. Appropriate management actions that target high-priority threats

receive greater analysis; actions that target more localized or minor threats may not be analyzed in as great detail. In addition to Federal plans, other conservation actions are also assessed. Where appropriate, the Service's Policy for Evaluation of Conservation Efforts (68 FR 15100, March 28, 2003) is used to assess actions that may be relied on in the listing decision.

Impacts of threats and regulatory and voluntary conservation actions are forecast using an analytical framework to assess percent of populations or degree of habitat persisting over time by comparing current with future situation. Since the species is not evenly distributed across the landscape, we do not believe that bird numbers or habitat acres in and of themselves are the appropriate predictors of the overall species status and its likely persistence into the future.

The spatial analyses used in the 2010 status review were simple and assumed 100 percent impact. For example, if an area could be developed, it was assumed that it would be developed completely. It was further assumed that developed areas would not be able to support any sage-grouse, or would be significantly degraded such that sustaining current populations would not be likely. This estimate of impact was based upon predictions in the literature. Our new analyses include multiple scenarios and may be at a finer scale (e.g., PAC, population). This finer scale allows us to analyze changes at population levels or management zones. The Service has used a number of analytical methods, including a Spatially Explicit Modelling (SEM) framework focused on current and future threats and conservation actions, using the COT spatial geography (i.e., PACs) and population data to project various outcomes, as measured by abundance and distribution; using U.S. Geological Survey facilitators to employ modeling techniques such as Bayesian belief networks to increase transparency and help produce defensible decisions; using expert elicitation with outside parties to solicit input about the degree to which threats will be relevant and impact sage-grouse into the future; and using peer-reviewed quantitative spatial models that incorporate stated assumptions, knowledge of existing threat reduction measures, a range of potential input values, and all best available science.

Comment [Craig5]: ? not spatial? Spatially explicit? Less complex?

Perhaps, "assumed that all potential threats impacted the species and its habitats equally across the range, at 100 percent" ?

Comment [Craig6]: ?

The SEMs, expert elicitation, and internal decision analysis require the highest level of effort and are used on those threats that have been identified as the most important drivers for the conservation of the species (long-term persistence). These, at a minimum, include invasive species and fire, energy development and associated infrastructure, and habitat conversion due to tilled agriculture. The remaining threats from the COT report, 2010 finding, and other information collected are evaluated and considered across the remainder of the range, populations, PACs, and individuals within this species report. Areas of interest are areas where threats may be concentrated, populations may have limited connectivity to neighboring populations, or the value of the birds in that area may be exceptionally high as it relates to the rest of the range.

The ultimate evaluation of listing status (i.e., whether the species is warranted for listing or not) will be informed in large part by the current status and trend of the species in the rest of the range, and the degree to which we predict the species, populations, and PACs will persist into the future. Given the number of threats and the uncertainty around those threats as they are likely to persist or increase into the future, as well as the evaluation of regulatory and non-regulatory conservation actions, we anticipate a wide range of modeling outcomes of abundance and distribution. These various outcomes, along with the qualitative evaluation of other threats and conservation actions, as summarized in this species report, will be the basis of one or more structured discussions regarding the reasonableness of our assumptions, risk to the species, exposure to threats, how far into the future that our predictions are reliable, the likelihood of the species persistence and the degree of persistence into the future.

The various outcomes from our structured prediction processes, along with the qualitative evaluation of other threats and conservation actions, as described and summarized in this species report, will be the basis of a structured workshop for Service personnel during which we will present, evaluate, analyze, and discuss the best available scientific and commercial information. After reviewing this information, Service personnel will evaluate whether the sage-grouse meets the definition of “threatened species” or “endangered species.” Within the range of the sage-grouse, one DPS has previously been identified (Bi-State). Through our analysis, we will determine

whether the remainder of the range, in whole or in part, warrants listing as threatened or endangered, and resolve the status of the Columbia Basin population.

Species report overview

This species report is intended to summarize the best available scientific and commercial information regarding sage-grouse and its habitat, including current status and trend of the species, and an evaluation of potential threats and conservation actions that may affect the species' ability to persist. In the Introduction and Background section of this species report, we first describe the history of Federal regulatory actions related to the species' status under the Act, and explain the process we have used to conduct this status review. In the Species Description chapter, we provide basic scientific background information about sage-grouse, including a description of the species, a basic overview of information related to taxonomy, and information about genetics. We also discuss the life history and ecology of sage-grouse, providing an overview of the basic biological needs and life history of the species. In this section, we discuss each life stage of sage-grouse, and describe lekking behavior and breeding, nesting, brood rearing, wintering, and movement patterns and migration corridors. The Current Biological Status chapter focuses on the best available information about the current status of the sage-grouse, including its historical and current range, distribution, and population status for each population of sage-grouse, organized by Management Zone. This section outlines what we know about the current condition of the species, particularly as it relates to the species' needs discussed in the previous section.

The Potential Threats section provides detailed information about potential threats to the species, including agricultural conversion, renewable and non-renewable energy development, contaminants, fences, fire, invasives, conifer encroachment, infrastructure, exurban development, free-roaming equids, grazing and rangeland management, climate change, disease, drought, hunting, mining, pesticides, small population size, predation, and recreation. Each potential threat is discussed in a separate chapter, using Management Zones as a common spatial scale. For each potential threat, we describe the stressor, including its historical and current sources. Then we describe its current impacts on sage-grouse, including the mechanism by which it may affect the species, the results of the impact to sage-grouse persistence, and the timing, location and extent of the impact, and whether it

Comment [SB7]: Based on the GRSG Species Report Outline document.

I have made a couple updates based on the latest version of the Species Report Outline, but I am flagging this to be updated at a later time too, since the process and organization of the species report seem to keep evolving!

has synergistic effects with other threats. Then we project the future impacts of each potential threat. We describe the timeframe for projecting the impact, the likelihood of future impacts, and whether the impacts are expected to change from their present level or scope. Finally, we describe any conservation efforts or management actions that are occurring that may ameliorate the potential threat, and their implementation and effectiveness. Each of these components feeds into an overall assessment of each potential threat to sage-grouse.

In the Cumulative Effects section, we summarize the threats, actions or measures in place to ameliorate the threats, and the overall species' status in each management zone. In the Cumulative and Compounding Threats chapter, we give a big picture assessment for each Management Zone of the combined impacts of all of the threats, considered collectively. In the Threat Amelioration chapter, we summarize activities that are reducing or ameliorating potential threats discussed in the previous section for each Management Zone. We also include a discussion of regulatory mechanisms that may address potential threats. This section provides a programmatic discussion of regulations and conservation efforts (their effectiveness at ameliorating individual threats is discussed under the appropriate threat chapter). We describe conservation measures, as well as relevant laws, regulations, policies, and management plans, including local land use laws; state laws; Federal laws implemented by the Bureau of Land Management, Forest Service, and other Federal agencies; and Canadian Federal and Provincial laws and regulations. In the Overall Summary of Species Status and Impacts chapter, we provide an overview of changes in the species' status that have occurred since the 2010 finding in each Management Zone. This section focuses on the key elements of the 2010 finding and any new important elements that have arisen since then, and discusses how those elements have changed over time, and the reason for those changes, if known. Finally, this chapter summarizes the main points of the analysis done in this species report and what they collectively mean for the overall biological status of the species as a whole.

Citations

U.S. Fish and Wildlife Service. 2013. Greater Sage-grouse (*Centrocercus urophasianus*) Conservation Objectives: Final Report. U.S. Fish and Wildlife Service, Denver, CO. February 2013.

Chapter 3: Species Description, Range, and Distribution

Greater Sage-grouse Species Description

The greater sage-grouse (*Centrocercus urophasianus*) is the largest North American grouse species. Adult male greater sage-grouse range in length from 66 to 76 centimeters (cm) (26 to 30 inches (in)) and weigh between 2 and 3 kilograms (kg) (4 and 7 pounds (lb)). Adult females are smaller, ranging in length from 48 to 58 cm (19 to 23 in) and weighing between 1 and 2 kg (2 and 4 lb). Males and females have dark grayish brown body plumage with many small gray and white spots, fleshy yellow combs over the eyes, long pointed tails, fully feathered legs and feet, and dark green toes. Males also have blackish chin and throat feathers, conspicuous phylloplumes (specialized erectile feathers) at the back of the head and neck, and white feathers forming a ruff around the neck and upper belly. During breeding displays, males exhibit olive green apteria (fleshy bare patches of skin) on their breasts (Schroeder *et al.* 1999, p.2).

Taxonomy

Greater sage-grouse are ~~members~~ birds in the ~~of the family~~ Phasianidae family, which is a diverse taxonomic group consisting of over 50 genera commonly known as grouse, turkeys, pheasants, partridges, francolins, and Old World quail. Greater sage-grouse are one of two species in the genus Centrocercus; the other being the Gunnison sage-grouse (*C. minimus*) (AOU 2000, pp. 849–850). The Gunnison sage-grouse was once considered part of a single sage-grouse species in the western United States, but was identified as a distinct species based on morphological (Hupp and Braun 1991,pp. 257–259; Young *et al.* 2000, pp. 447–448), genetic (Kahn *et al.* 1999, pp. 820-821; Oyler-McCance *et al.* 1999, pp.1460–1462), and behavioral (Barber1991, pp. 6–9; Young 1994; Young *et al.*2000, p. 449–451) differences and geographical isolation (Young *et al.*2000, pp. 447–451) (AOU 2000, pp. 849–850)..

In 1957, prior to the Gunnison sage-grouse being described as a distinct species, the American Ornithologists' Union (AOU) recognized two subspecies of sage-grouse, the eastern sage-grouse (*Centrocercus urophasianus urophasianus*) and the western sage-grouse (C. u. phaios) (AOU 1957, p. 139). This subspecies classification was

Comment [Craig8]: "…which includes grouse, turkeys, pheasants…"

Comment [Craig9]: "found in"

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Comment [Craig10]: ?

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Comment [Craig12]: check citation formatting.

based solely on differences in coloration (specifically, reduced white markings and darker feathering on western birds) among 11 museum specimens collected from 8 locations in Washington, Oregon and California (Aldrich 1946, p. 129).

The 1957 AOU subspecies classification has not been revisited by AOU since 1957 and that taxonomic classification has been determined to be invalid by more recent information, including information on morphology, behavior, geography, and molecular genetics (Johnsgard 1983, p. 109; 2002, p. 108; Drut 1994, p. 2; Schroeder *et al.* 1999, p. 3; Banks 2000, 2002; Benedict *et al.* 2003, p. 301; (75 FR 13910, pp. 13912–13915). Thus, our analysis of the status of the greater sage-grouse (below) does not address considerations at the scale of subspecies. See the Taxonomy section of the FWS 2010 12-month finding (75 FR 13910~~–~~; March 23, 2010, p. 13912) for additional details.

Genetics—PLACEHOLDER (Craig/Jesse – roll into small pops??)

Greater sage-grouse habitat–The sagebrush ecosystem

Greater sage-grouse (*Centrocercus urophasianus*; hereafter sage-grouse) depend on a variety of shrub-steppe habitats throughout their life cycle, and is a sagebrush (Artemisia spp.) obligate (Patterson 1952, p. 48). Variable by elevation, location, and ecological site characteristics (fig. 1) across the range, sage-grouse use a variety of sagebrush species including but not limited to: Wyoming big sagebrush (Artemisia tridentata wyomingensis), mountain big sagebrush (A. t. vaseyana), basin big sagebrush (A. t. tridentate), black sagebrush (A. nova), fringed sagebrush (A. frigida), silver sagebrush (A. cana), and little sagebrush (A. arbuscula) (Patterson 1952, p. 48; Braun *et al.* 1976, p. 168; Schroeder *et al.* 1999, pp. 4-5; Connelly *et al.* 2000a, pp. 970-972; Connelly *et al.* 2004, p. 3-4; Connelly *et al.* 2004, p. 4-1; Miller *et al.* 2011, p. 145). Thus, sage-grouse distribution is strongly correlated with the distribution of sagebrush habitats (Schroeder *et al.* 2004, p. 364). Sage-grouse exhibit strong site fidelity (loyalty to a particular area even when the area is no longer of value) to seasonal habitats, which includes breeding, nesting, brood rearing, and wintering areas (Connelly *et al.* 2004, p. 3-1; Connelly *et al.* 2011, p. 60 and references therein).

Comment [Craig13]: Missing ( ) check. Also FR citation page numbers.

Comment [Craig14]: Check this, the page number can go after the FR.

Comment [Craig15]: In 2010, this was a subsection of the taxonomy section needed to explain the genetic evidence for not recognizing the subspecies. It did not address small populations, barriers, or gene flow across the range.

Comment [KNorman16]: Craig, Jesse, reusing 2010 and DPS

Formatted: Font: (Default) Times New Roman, Highlight

Comment [DMD17]: I suggest updating this with the citation from SAB, which provides a summary of site fidelity (e.g., leks, females to nesting areas).

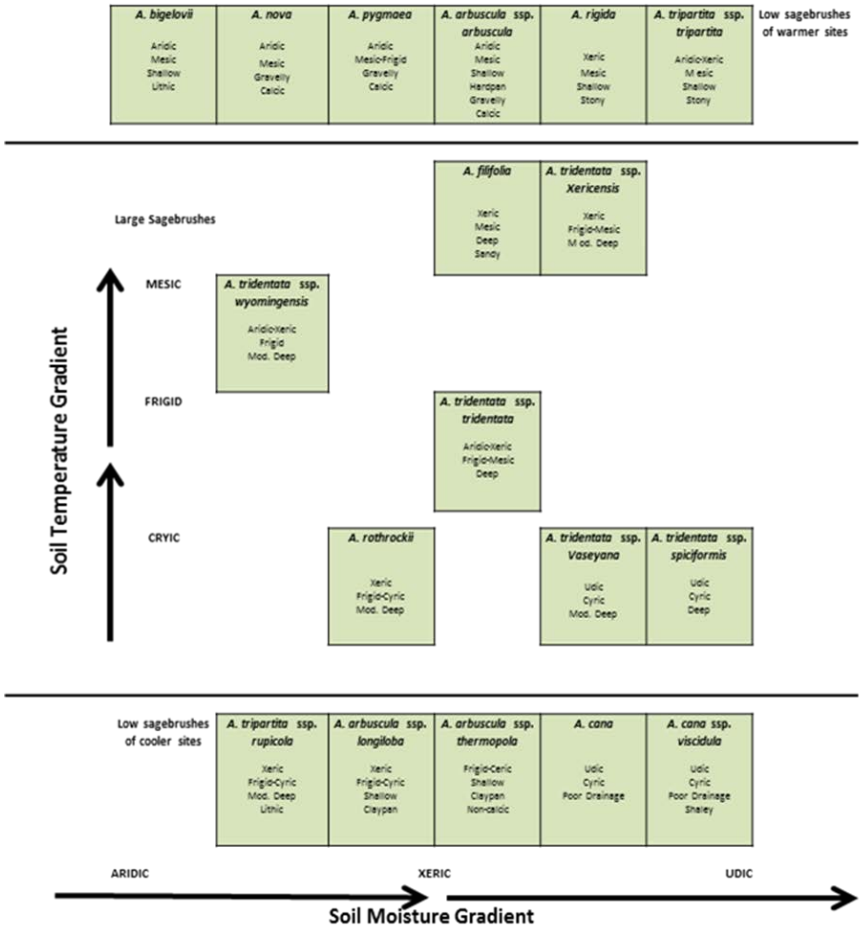


Figure 3-1. Ordination of major sagebrush taxa in the Intermountain Region against gradients of soil temperature and moisture (From Miller *et al.* 2011)

Comment [acn18]: I created this draft figure after Miller, I'm not married to it though. And will make better/prettier figure if we decide to keep.

Sage-grouse are dependent on large areas of contiguous sagebrush (Patterson 1952, p. 48; Connelly *et al.* 2004, p. 4-1; Connelly *et al.* 2011, pp. 82–83; Wisdom *et al.* 2011, p. 465), and large-scale characteristics within surrounding landscapes influence sage-grouse habitat selection (Knick and Hanser 2011, pp. 396–405). Sagebrush is the most widespread vegetation in the intermountain lowlands in the western United States (West and Young

2000, p. 259), and is considered one of the most imperiled ecosystems in North America (Knick *et al*. 2003, p. 612; Miller *et al*. 2011, p. 452, and references therein). Scientists recognize 13 species and 12 subspecies of sagebrush (Shultz 2009, p. 1), each with unique habitat requirements and responses to perturbations (West and Young 2000, p. 259). Sagebrush species and subspecies occurrence in an area is dictated by local soil type, soil moisture, and climatic conditions (West 1983, p. 333; West and Young 2000, p. 260; Miller *et al*. 2011, pp. 151–154). The degree of dominance by sagebrush varies with local site conditions and disturbance history. Plant associations, typically defined by native perennial grasses, further define distinctive sagebrush communities (Miller and Eddleman 2000, pp. 10-14; Connelly *et al*. 2004, p. 5-3), and are influenced by topography, elevation, precipitation, and soil type. These ecological site conditions influence the resistance and resiliency of sagebrush and their associated understories to natural and human-caused changes (Chambers *et al*. 2014, entire).

Sagebrush is typically divided into two groups, big sagebrush and low or dwarf sagebrush, based on their affinities for different soil types (West and Young 2000, p. 259). Big sagebrush species and subspecies, such as Wyoming big sagebrush, are limited to coarse-textured and/or well-drained sediments, whereas low (or dwarf) forms of sagebrush, such as black sage, typically occur where erosion has exposed clay or calcified soil horizons (West 1983, p. 334; West and Young 2000, p. 261). Reflecting these soil differences, big sagebrush will die if surfaces are saturated long enough to create anaerobic conditions for 2 to 3 days (West and Young 2000, p. 259). Some low sagebrush are more tolerant of occasionally saturated soils, and many low sagebrush sites are partially flooded during spring snowmelt. None of the sagebrush taxa tolerate soils with high salinity (West 1983, p. 333; West and Young 2000, p. 257).

Comment [LW 19]:
Highlighting these could devalue the numerous other dozen(s) type of sagebrush and hybrids used by grouse.

All species of sagebrush produce large ephemeral leaves in the spring, which persist until reduced soil moisture occurs in the summer. Most species also produce smaller, over-wintering leaves in the late spring that last through summer and winter. Sagebrush have fibrous tap root systems, which allow the plants to draw surface soil moisture, and also to access water deep within the soil profile when surface water is limited (West and Young 2000, p. 259). Most sagebrush flower in the fall. However, during years of drought, or other moisture stress, flowering may not occur. Although seed viability and germination are high, seed dispersal is limited (citation?).

Additionally, , sagebrush seeds typically do not remain viable for more than one growing season and evidence suggests seed banks are transient (i.e., seeds persist in the soil less than one year); however, seeds have higher odds of persisting in the seed bank if they are buried (Wijayratne and Pyke 2012, p. 438). (West and Young 2000, p. 260).

Comment [DMD20]: Wijayratne, U. P., and D. A. Pyke. 2012. Burial increases seed longevity of two *Artemisia tridentata* (Asteraceae) subspecies. American Journal of Botany 99:438-447.

Sagebrush is long-lived, with plants of some species surviving up to 150 years (West 1983, p. 340). Sagebrush exhibit allelopathic effects, producing chemicals that reduce seed germination, seedling growth and root respiration of competing plant species and inhibit the activity of soil microbes and nitrogen fixation. Sagebrush has resistance to environmental extremes, with the exception of fire and occasionally defoliating insects (e.g., the webworm (Aroga spp.); West 1983, p. 341). Most species of sagebrush are killed by fire (Miller and Eddleman 2000, p. 17; West 1983, p. 341; West and Young 2000, p. 259). Depending on the species of sagebrush and other site-specific characteristics, fire return intervals from 10 to well over 300 years have been reported (McArthur 1994, p. 347; Peters and Bunting 1994, p. 33; Miller and Rose 1999, p. 556; Kilpatrick 2000, p. 1; Frost 1998, in Connelly *et al*. 2004, p. 7-4; Zouhar *et al*. 2008, p. 154; Baker 2011, pp. 190–197; Bukowski and Baker 2013, entire). In general, mean fire return intervals in low-lying, xeric, big sagebrush communities range from over 100 to 350 years, and return intervals decrease to 50 to over 200 years in more mesic areas, mountain sagebrush communities at higher elevations, during wetter climatic periods, and in locations associated with grasslands (Baker 2006, p. 181; Mensing *et al*. 2006, p. 75; Baker 2011, pp. 194-195; Miller *et al*. 2011, p. 166; Bukowski and Baker 2013, entire). Natural sagebrush re-colonization in burned areas depends on the presence of adjacent live plants for a seed source or on the seed bank, if present (Miller and Eddleman 2000, p. 17).

Comment [acn21]: I copied this directly from fire chapter.

Plants associated with the sagebrush understory, and their productivity also vary widely and are influenced by moisture availability, soil characteristics, climate, and topographic position (Miller *et al*. 2011,, pp. 151–154). Forb abundance can be highly variable from year to year and is largely affected by the amount and timing of precipitation.

Very little sagebrush within its extant range is undisturbed or unaltered from its condition prior to EuroAmerican settlement in the late 1800s (Knick *et al*. 2003, p. 612, and references therein). Due to the disruption of primary patterns, processes and components of sagebrush ecosystems since EuroAmerican settlement (Knick *et al*. 2003, p. 612; Miller *et al*. 2011, p. 147), the large range of abiotic variation, the minimal short-lived seed banks, and the long generation time of sagebrush, restoration of disturbed areas is very difficult. Not all areas previously dominated by sagebrush can be restored because alteration of vegetation, nutrient cycles, topsoil, and cryptobiotic soil crusts have exceeded recovery thresholds (Knick *et al*. 2003, p. 620). Additionally, processes to restore sagebrush ecology are relatively unknown (Knick *et al*. 2003, p.620). Active restoration activities are often limited by financial and logistic resources and lack of political motivation (Knick *et al*. 2003, p.620; Miller *et al*. 2011, p. 147) and may require decades or centuries (Knick *et al*. 2003, p.620, and references therein). Meaningful restoration for sage-grouse requires landscape, watershed, or eco-regional scale context rather than individual, unconnected efforts (Knick *et al*. 2003, p.623, and references therein; Wisdom *et al*. 2011, p. 469). Landscape restoration efforts require partnerships across multiple ownerships and jurisdictions in order to restore and maintain a connective network of intact vegetation (Knick *et al*. 2003, p. 623; Pyke 2011, p. 548; see discussion of landownership below). Except for areas where active restoration is attempted following disturbance (e.g., mining, wildfire), management efforts in sagebrush ecosystems are usually focused on maintenance (Miller *et al*. 2011, p. 183; Wisdom *et al*.2011, pp. 470, 472).

Comment [DMD22]: Also see Pyke 2011, p. 544 who found that rehabilitation and restoration efforts are also hindered by cost and the ability to procure the equipment and seed needed for projects.

Although sage-grouse require large, interconnected expanses of sagebrush with healthy, native understories (Patterson 1952; Connelly *et al*. 2004, pp. 4-15; Knick *et al*. 2003, p. 623; Connelly *et al*. 2011b, p. 80; Pyke 2011, p. 540; Wisdom *et al*. 2011, p. 461), there is little information available regarding minimum sagebrush patch sizes required to support populations of sage-grouse. This is due in part to the migratory nature of some, but not all sage-grouse populations, the lack of juxtaposition of seasonal habitats, and differences in local, regional and range-wide ecological conditions which influences the distribution of sagebrush and associated understories. Where home ranges have been reported (Connelly *et al*. 2011a, p. 60 and references therein) they are extremely variable (4 to 615 km2 range [1.5 to 237.5 mi2]). Occupancy of a home range is also based on multiple variables,

associated with both local vegetation characteristics and landscape characteristics (Knick *et al.* 2003, p. 621). Pyke (2011, p. 540) estimated that a minimum of 4,000 ha (9,884 acres) was necessary for population sustainability. However, he did not indicate whether this value was for migratory or non-migratory populations, nor if this included juxtaposition of all seasonal habitats. Large seasonal and annual movements emphasize the landscape nature of the sage-grouse (Knick *et al.* 2003, p. 624; Connelly *et al.* 2011a, p. 60).

Comment [DMD23]: This estimate is not from Pyke, instead he cites Leonard et al (2000) who reports values for migratory sage-grouse populations in Idaho and Walker et al. (2007).

Migratory populations of sage-grouse may use areas exceeding 2700 km^2 (e.g., Leonard et al. (2000)

Diurnal space use and seasonal movement patterns observed by Davis et al. (2014) exceeded estimates of individual home range size reported in previous investigations. The cumulative annual range was within a 3072 km^2 area (based on MCP).

Seasonal Habitat Selection and Life History Characteristics

Sage-grouse are dependent of seasonal habitats for persistence..say something here about how critical each of these seasonal habitats are for sage-grouse persistence.

Breeding habitat

During the breeding season, male sage-grouse gather together to perform courtship displays on areas called leks. Areas are often characterized by having bare soil, short-grass steppe, windswept ridges, exposed knolls, or other relatively open sites typically serve as leks (Patterson 1952, p. 83; Connelly *et al.* 2004, p. 3-7 and references therein). Leks are often surrounded by denser shrub-steppe cover, which is used for escape, thermal, and feeding cover. Leks can be formed opportunistically at any appropriate site within or adjacent to nesting habitat (Connelly *et al.* 2000a, p. 970), and therefore lek habitat availability is not considered to be a limiting factor for sage-grouse (Schroeder 1999, p. 4). Leks range in size from less than 0.04 hectare (ha) (0.1 ac) to over 36 ha (90 ac) (Connelly *et al.* 2004, p. 4-3) and can host from several to hundreds of males (Johnsgard 2002, p. 112). Males defend individual territories within leks and perform elaborate displays with their specialized plumage and vocalizations to attract females for mating. Numerous researchers have observed that a relatively small number of dominant males account for the majority of copulations on each lek (Schroeder *et al.* 1999, p. 8). Bush *et al.* (2013, p. 33), however, found on average that 45.9 percent (range 14.3 to 54.5 percent) of genetically identified

Comment [DMD24]: Bush et al. (2013) The secret lives of sage-grouse: multiple paternity and intraspecific nest parasitism revealed through genetic analysis. Behavioral Ecology 24:29-38.

males in a population fathered offspring in a given year. This more recent work suggests that males and females likely engage in off-lek copulations. Males do not participate in incubation of eggs or rearing chicks.

Nesting habitat

Females have been documented to travel more than 20 km (12.5 mi) to their nest site after mating (Connelly *et al.* 2000a, p. 970), but distances between a nest site and the lek on which breeding occurred is variable (Connelly *et al.* 2004, pp. 4-5). Average distance between a female's nest and the lek on which she was first observed ranged from 3.4 km (2.1 miles) to 7.8 km (4.8 miles) in five studies examining 301 nest locations (Schroeder *et al.* 1999 p. 12). Other studies have reported the average lek-to-nest distance was larger for the lek of capture compared with the distance to the nearest lek (Petersen 1980, Wakkinen *et al.* 1992a, Fischer 1994, Schroeder *et al.* 1999, Herman-Brunson 2007). In northeastern California (Davis *et al.* 2014) the average distance between a female's nest and the nearest lek was 3.69 km ± 2.94 SD (n = 74) and ranged from 0.14 km to 14.10 km. These results are consistent with other studies conducted in peripheral populations (Aldridge and Brigham 2001, Herman-Brunson *et al.* 2009, Wiechman 2013),

Research by Bradbury *et al.* (1989, p. 22) and Wakkinen *et al.* (1992, p. 382) demonstrated that nest sites are selected independent of lek locations, but that the reverse is not true.

Productive nesting areas are typically characterized by sagebrush with an understory of native grasses and forbs, with horizontal and vertical structural diversity that provides an insect prey base, herbaceous forage for pre-laying and nesting hens (Barnett and Crawford 1994, p. 116), and cover for the hen while she is incubating (Gregg 1991, p. 19; Schroeder *et al.* 1999, p. 4; Connelly *et al.* 2000a, p. 971; Connelly *et al.* 2004, pp.4-17, 18). Sage-grouse may also use other shrub or bunchgrass species for nest sites (Klebenow 1969, p. 649; Connelly *et al.* 2000a, p.970; Connelly *et al.* 2004, p. 4-4, Davis *et al.* 2014, p. 5). Shrub canopy and grass cover provide concealment for sage-grouse nests and young (Gregg *et al.* 1994, p. 164; DeLong *et al.*1995, p. 90; Connelly *et al.* 2004, p. 4-4), and forb availability and abundance are critical for reproductive success (Barnett and Crawford 1994, p.116; Gregg *et al.* 2008, p. 539)). Published vegetation characteristics of successful nest sites included a sagebrush

Comment [LW 25]:
We can probably update that…
I'll look for a few citations.
AMY: yah, there was a recent presentation, can't remember who?? That had distances for success full nest, renest, etc.

DMD: Connelly et al. 2011 (and references therein) summarizes this on p. 62 in SAB. Davis et al. (2014) reported that the average distance females moved from lek sites of capture to initial nest locations was 4.67 km ± 4.30 SD (n = 59). This distance is within the range reported for other sage-grouse studies (0.40–29.75 km; Schroeder et al. 1999, Aldridge and Brigham 2001, Moynahan et al. 2007).

Comment [DMD26]: Davis et al. 2014. Demography, reproductive ecology, and variation in survival of greater sage-grouse in NE California. JWM DOI: 10.1002/jwmg.797

Comment [DMD27]: Gregg et al. (2008) Temporal variation in diet and nutrition of preincubating greater sage-grouse. Rangeland Ecology and Management 61:535-542.

canopy cover of 15-25 percent, sagebrush heights of 30 – 80 cm (11.8 – 31.5 in), and grass/forb cover of 18 cm (7.1 in; Connelly *et al*. 2000a, p. 977).

Sage-grouse clutch size ranges from 6 to 9 eggs with an average of 7 eggs. (Connelly *et al*. 2011a, p.62). The likelihood of a female nesting in a given year averages 82 percent in the eastern portion of the range and 78 percent in the western portion of the range (Connelly *et al*. 2011a, p. 63). Adult females have higher nest initiation rates than yearling females (Connelly *et al*. 2011a, p. 58). Nest success (one or more eggs hatching from a nest), as reported in the scientific literature, varies widely (reported as 15 to 86 percent of initiated nests Schroeder *et al*. 1999, p. 11; 12 to 71 percent of initiated nests in Connelly *et al*. 2011a, p. 58). Overall, the average nest success for sage-grouse in non-altered habitats is 51 percent and for sage-grouse in altered habitats is 37 percent (Connelly *et al*. 2011a, p. 58). Re-nesting only occurs if the original nest is lost (Schroeder *et al*. 1999, p. 11). Sage-grouse re-nesting rates average 28.9 percent (based on 9 different studies) with a range from 5 to 41 percent (Connelly *et al*. 2004. p. 3-11). Other game bird species have much higher re-nesting rates, often exceeding 75 percent. The impact of re-nesting on annual productivity for most sage-grouse populations is unclear and thought to be limited (Crawford *et al*. 2004, p. 4). In north-central Washington State, re-nesting contributed to 38 percent of the annual productivity of that population (Schroeder 1997, p. 937). However, the author postulated that the re-nesting efforts in this population may be greater than anywhere else in the species' range because environmental conditions allow a longer period of time to successfully rear a clutch (Schroeder 1997, p. 939).

Little information is available on the level of productivity (number of chicks per hen that survive to fall) that is necessary to maintain a stable population (Connelly *et al*. 2000b, p. 970). However, Connelly *et al*. (2000b, p. 970, and references therein) suggest that 2.25 chicks per hen are necessary to maintain stable to increasing populations. Long-term productivity estimates of 1.40 to 2.96 chicks per hen across the species range have been reported (Connelly and Braun 1997, p. 20). Productivity declined slightly after 1985 to 1.21 to 2.19 chicks per hen (Connelly and Braun 1997, p. 20). A recent study assessing the population structure of sage-grouse based on the collection and analysis of over 67,000 wings from hunter harvested birds in Colorado and Oregon during

Comment [DMD28]: Also see the meta-analysis by Hagen et al. (2007).

A meta-analysis for greater sage-grouse nesting and brood rearing habitats. Wildlife Biology 13:42-50.

Comment [LW 29]: We can update from SAB…

Comment [LW 30]: Update from SAB

Comment [acn31]: I think we have some new info here, but was transmitter surgically on chicks which really makes me question results, but should mention. Find paper..

DMD: Traditional studies assessing chick survival do not report their findings in terms of number of chicks per hen but as daily survival estimates. Declining populations may be characterized by poor recruitment largely attributed to low chick survival but I'm not sure if that discussion is appropriate here?

1973-1998 and 1993-2013 found the average number of juveniles in the harvest per female varied from 1.2 to 2.4 (Braun *et al*. 2015, p. 10). Despite average clutch sizes of 7 eggs (Connelly *et al*. 2011a, p.62) due to low chick survival and limited re-nesting, there is little evidence that populations of sage-grouse produce large annual surpluses (Connelly *et al*. 2011a, p. 67).

Comment [DMD32]: Braun et al. 2015. Fall population structure of sage-grouse in Colorado and Oregon. Wildlife Technical Report 005-2015.

Brood-rearing habitat

Hens rear their broods in the vicinity of the nest site for the first 2 to 3 weeks following hatching (0.2 to 5 km (0.1 to 3.1 miles), based on two studies in Wyoming (Connelly *et al*. 2004, p. 4-8). Forbs and insects are essential nutritional components for chicks (Klebenow and Gray 1968, p. 81; Johnson and Boyce 1991, p. 90; Connelly *et al*. 2004, p. 4-9). Therefore, early brood-rearing habitat must provide adequate cover (sagebrush canopy cover of 10 to 25 percent; Connelly *et al*. 2000a, p. 977) adjacent to areas rich in forbs and insects to assure chick survival during this period (Connelly *et al*. 2004, p. 4-9).

All sage-grouse gradually move from sagebrush uplands to more mesic areas during the late brood-rearing period (3 weeks post-hatch) in response to summer desiccation of herbaceous vegetation (Connelly *et al*. 2000a, p. 971). Summer use areas can include sagebrush habitats as well as riparian areas, wet meadows, and alfalfa fields (Schroeder *et al*. 1999, p. 4). These areas provide an abundance of forbs and insects for both hens and chicks (Schroeder *et al*. 1999, p. 4; Connelly *et al*. 2000a, p. 971). Sage-grouse will use free water although they do not require it since they obtain their water needs from the food they eat. However, natural water bodies and reservoirs can provide mesic areas for succulent forb and insect production, thereby attracting sage-grouse hens with broods (Connelly *et al*. 2004, p. 4-12). Broodless hens and cocks will also use more mesic areas in close proximity to sagebrush cover during the late summer, often arriving before hens with broods (Connelly *et al*. 2004, p. 4-10).

Comment [DMD33]: Early and late brood-rearing periods have typically been based on observations on habitat use by hens with 6-week-old broods (Martin 1970) and information from Peterson (1970), who found a dietary change in juvenile sage-grouse approximately 6 weeks after Hatching. But see Blomberg et al. 2013

Winter habitat

Sage-grouse are considered a sagebrush obligate and that designation becomes most obvious during the winter when birds depend almost exclusively on sagebrush for both food and cover (Schroeder 1999, p. 5; Thacker *et al*. 2012, p. 588). Winter areas used by sage-grouse are characterized by large expanses of big sagebrush and tall

shrubs, predominantly located on relatively gentle south or west-facing slopes that provide more favorable thermal conditions and above snow forage (Beck 1977, p. 22; Hupp and Braun 1987, p. 826; Doherty *et al*. 2008, p. 192; Hagen *et al*. 2011, p. 536; Dzialak *et al*. 2013, p. 16). During the winter, sage-grouse avoid bare ground, conifer and riparian areas, and anthropogenic features (e.g., roads, energy development) (Beck 1977, p. 21; Doherty *et al*. 2008, p. 192; Carpenter *et al*. 2010, p. 1811; Dzialak *et al*. 2012, p. 12; Dzialak *et al*. 2013, p. 16; Smith *et al*. 2014, p. 15).

Winter habitats may overlap with or be relatively close to nesting or brood-rearing habitats, or they may be totally separated, requiring significant movement to achieve (Fedy *et al*. 2012, p. 1068). The timing of movement to winter ranges varies considerably, but peaks around mid-October through late November (Schroeder *et al*. 1999, p. 10). Movement has been described as slow and meandering, with birds typically traveling less than 1km per day (Connelly *et al* 1988, p. 119). The distance sage-grouse travel (walking and flying) to reach wintering areas is highly variable both within and among populations (Fedy *et al*. 2012, p. 1067). For example, sage-grouse in Idaho on average moved less than 15 km, but some individuals moved greater than 80 km to reach their winter range (Connelly *et al*. 1988, p. 119). The average movement of sage-grouse in Wyoming from summer to winter locations was 17.3 km, but the minimum and maximum distances recorded were 0.33 and 83km, respectively (Fedy *et al* 2012, p. 1067). A population in Canada travels annually to a winter range in Montana, a distance of more than 120 km one way and the longest documented annual migration for sage-grouse (Tack *et al*. 2012, p. 65). The high degree of variability both within and among populations makes generalizations on winter habitat locations in relation to other seasonal habitats difficult (Fedy *et al*. 2012, p. 1067).

Sage-grouse exhibit fidelity to winter sites (Berry and Eng 1985, p. 239). The degree of fidelity, however, may be somewhat more relaxed than for other seasonal habitats, as birds have displayed some ability to shift winter habitat use in response to severe conditions by moving to areas where sagebrush remains above the snow (Beck 1977, p. 24; Smith 2010, p. 8).

Sage-grouse are supremely adapted to the incredibly harsh conditions typical of a winter on the sagebrush steppe which is characterized by periods of sub-zero temperatures, extreme winds, limited shelter, and snow. For example, sage-grouse have feathered legs and feet with small narrow scales adept for walking and burrowing in the snow for shelter and to forage (Patterson 1952, p. 6). All sage-grouse switch from diets containing varying amounts of sagebrush, forbs, and insects to a diet that consists almost entirely of sagebrush (Schroeder *et al.* 1999, p. 5).

Despite these challenging conditions, during the average winter sage-grouse typically experience low overwinter mortality (2 percent, Connelly *et al.* 2000b, p. 229; 0 to 15 percent Wik 2002, p. 40; 2 to 3 percent Sika 2006, p. 90; 4 percent, Bruce *et al.* 2011, p. 421). In fact, sage-grouse not only survive the winter, but actual weight gain over the winter months has been documented (Beck and Braun 1978, p. 243). During notably severe winters, however, even sage-grouse are not immune from the elements and significant population-level mortality has been documented (58 percent, Moynahan *et al.* 2006, p. 1536; 54 percent, Anthony and Willis 2008, p. 544).

The distribution and abundance of suitable winter habitats is limited. In northern Colorado, only 6.8 percent of the area was intensively used by sage-grouse during the winter (Beck 1977, p. 20). In south-central Wyoming, only 7-18 percent of a 4,328 km2 study area was identified as having characteristics suitable for severe winter habitat (Dzialak *et al.* 2013, p. 10). Similarly, winter habitat was limited in northwest Colorado and south-central Wyoming, representing only 17.1 percent of the 6,093 km2 study area (Smith *et al.* 2014, p. 12) In south central Montana, the numbers of males counted on leks declined by 73 percent following a 30 percent loss of winter habitat to cropland conversion (Swenson *et al.* 1987, p. 128). This significant decline happened despite the fact that 84 percent of the total area remained unploughed sagebrush-steppe (Swenson *et al.* 1987, p. 128).

Comment [DMD34]: Smith et al. 2014. Prioritizing winter habitat quality for greater sage-grouse in a landscape influenced by energy development. Ecosphere 5:15. http://dx.doi.org/10.1890/ES13-00238.

The above information highlights the importance of winter habitats to sage-grouse persistence. Clearly loss of these essential winter habitats can have impacts disproportionate to their makeup on the landscape (Swenson *et al.* 1987, p. 128). Winter habitat can be even more limited during severe winters when heavy snow fall further decreases or even eliminates access to sagebrush (as a consequence of increasing snow depth). During such times

birds become even more concentrated in the few remaining areas of exposed sagebrush critical for shelter and foraging (Beck 1977, p. 24; Hupp and Braun 1987, p. 828). Thus, areas critical to survival during winters with heavy snowfall, may not be the same areas the birds regularly occupy during an average winter (Caudill *et al*. 2013, p. 256).

Migratory Corridors

Many populations of sage-grouse migrate between seasonal ranges in response to habitat distribution (Connelly *et al*. 2004, p. 3-5). Migration can occur between winter and breeding/summer areas, between breeding, summer and winter areas, or not at all. Migration distances of up to 161 kilometers (km) (100 mi) have been recorded (Patterson 1952, p.189); however, distances vary depending on the locations of seasonal habitats (Schroeder *et al*. 1999, p. 3). Migration distances for female sage-grouse generally are less than for males (Connelly *et al*. 2004, p. 3-4), but in one study in Colorado, females travelled further than males (Braun and Beck, 1976). Almost no information is available regarding the distribution and characteristics of migration corridors for sage-grouse (Connelly *et al*. 2004, p. 4-19). Sage-grouse dispersal (permanent moves to other areas) is poorly understood (Connelly *et al*. 2004, p. 3-5) and appears to be sporadic (Dunn and Braun 1986, p. 89). Despite the documentation of extensive seasonal movements in this species (Fedy *et al*. 2012, p. 1066; Tack *et al*. 2012, p. 65; Davis *et al*. 2014, pp. 5–7), the dispersal abilities of sage-grouse are assumed to be low (e.g., median natal dispersal distance = 8.8 km for females versus 7.4 km for males [Dunn and Braun 1985, p. 622] and 3.8 ± 1.3 km and 2.7 ± 0.3 km, for males and females, respectively [Thompson 2012, p. 193]). Estimating an 'average' home range for sage-grouse is difficult due to the large variation in sage-grouse movements both within and among populations. This variation is related to the spatial availability of habitats required for seasonal use and annual recorded home ranges have varied from 4 - 615 km2 (1.5 – 237.5 mi2; Connelly *et al*. 2011a, p.60).

Historical and Current Range

Range and Distribution of Sage-Grouse and Sagebrush

Comment [LW 35]: Add in description of: nonmigratory, 1-stage, and 2-stage migratory individuals as well as that multiple can be present in any one population.

DMD: See p. 59 of SAB for description of the 3 sage-grouse movement patterns (non-migratory; on-stage; and two-state migration) cited from Connelly et al. 2000.

Comment [acn36]: Note for later, we can't use special characters in FR docs, so I was trying to keep them out of report also (to facilitate future cut and paste into FR doc)

Comment [DMD37]: Previous investigations describing space use by sage-grouse have been constrained by highly variable seasonal movement patterns within and among populations, limited sample size, variation in the duration of the study, and variation in methods of home range estimation (e.g., Hagen 1999, Leonard et al. 2000, Hausleitner 2003, Fedy et al. 2012). Moreover, the extensive movements between seasonal ranges and highly clustered distributions of sage-grouse (Hagen et al. 2001) have made estimating home range size and comparisons between studies difficult.

Prior to settlement of western North America by European immigrants in the 19th century, greater sage grouse occurred in 13 States and 3 Canadian provinces—Washington, Oregon, California, Nevada, Idaho, Montana, Wyoming, Colorado, Utah, South Dakota, North Dakota, Nebraska, Arizona, British Columbia, Alberta, and Saskatchewan (Schroeder *et al*. 1999, p. 2; Young *et al*. 2000, p. 445; Schroeder *et al*. 2004, p. 369) (Figure X-1). Sagebrush habitats that potentially supported sage-grouse occurred over approximately 1,200,483 km2 (463,509 mi2) before 1800 (Schroeder *et al*. 2004, p. 366). Currently, greater sage-grouse occur in 11 States (Washington, Oregon, California, Nevada, Idaho, Montana, Wyoming, Colorado, Utah, South Dakota, and North Dakota), and 2 Canadian provinces (Alberta and Saskatchewan), occupying approximately 56 percent of their historical range (Schroeder *et al*. 2004, p. 369) (Figure X-1). Approximately 2 percent of the total range of the greater sage-grouse occurs in Canada, with the remainder in the United States (Knick in press, p. 14).

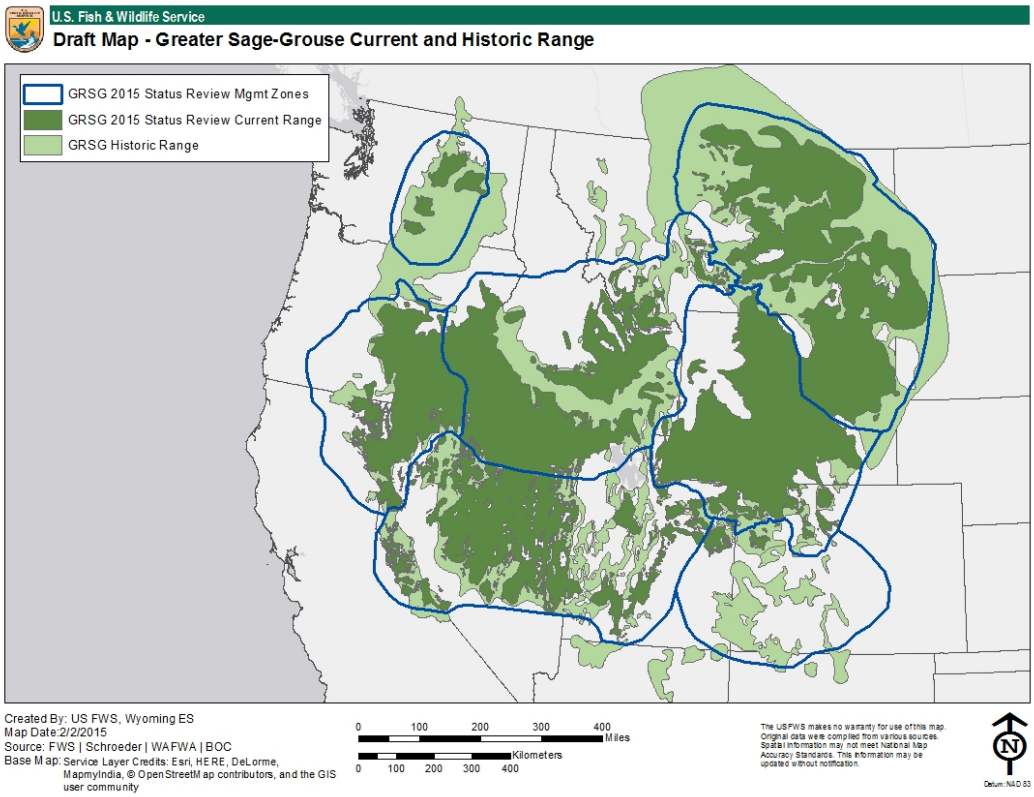


Figure 3-2. Placeholder DRAFT Map

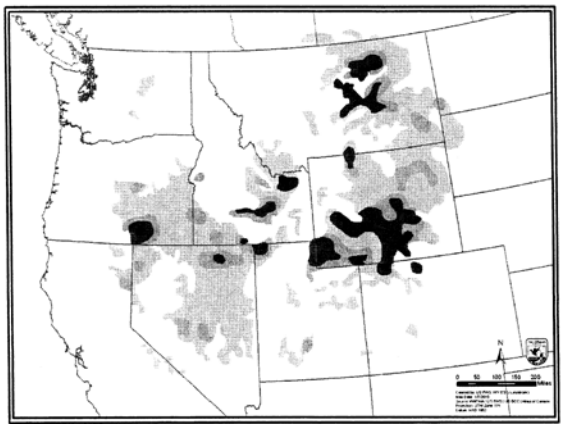
Sage-grouse have been extirpated from Nebraska, British Columbia, and possibly Arizona (Schroeder *et al.* 1999, 2; Young *et al.* 2000 p. 445; Schroeder *et al.* 2004, p. 369). Current distribution of the greater sage-grouse is estimated at 668,412 km2 (258,075 mi2; Connelly *et al.* 2004, p. 6-9; Schroeder *et al.* 2004, 369). Changes in distribution are the result of sagebrush alteration and degradation (Schroeder *et al.* 2004, p. 363).

Comment [acn38]: Use jim's numbers?? Of occupied habitat?

Sage-grouse distribution is associated with sagebrush (Schroeder *et al.* 2004; p. 364), although sagebrush is more widely distributed. However, sagebrush does not always provide suitable habitat due to fragmentation and degradation (Schroeder *et al.* 2004, pp. 369, 372). Very little of the extant sagebrush is undisturbed, with up to 50

to 60 percent having altered understories or having been lost to direct conversion (Knick *et al*. 2003, p. 612). There also are challenges in mapping altered and depleted understories, particularly in semi-arid regions, so maps depicting only sagebrush as a dominant cover type are deceptive in their reflection of habitat quality and, therefore, use by sage-grouse (Knick *et al*. 2003, p. 616). As such, variations in the quality of sagebrush habitats (from either abiotic or anthropogenic events) are reflected by sage-grouse distribution and densities (Figure X-placeholder map below).

Figure 1—Greater sage-grouse population densities based on average number of males per lek (from Stiver *et al.* 2006, p. 1-12). Darker areas indicate higher breeding population densities.



PLACEHOLDER: Get new density layer from Kevin

Sagebrush occurs in two natural vegetation types that are delineated by temperature and patterns of precipitation (Miller *et al*. in press, p. 7). Sagebrush steppe ranges across the northern portion of sage-grouse range, from British Columbia and the Columbia Basin, through the northern Great Basin, Snake River Plain, and Montana, and into the Wyoming Basin and northern Colorado. Great Basin sagebrush occurs south of sagebrush steppe, and extends from the Colorado Plateau westward into Nevada, Utah, and California (Miller *et al*. in press, p. 7). Other sagebrush types within greater sage-grouse range include mixed-desert shrubland in the Bighorn Basin of

Wyoming, and grasslands in eastern Montana and Wyoming that also support A. cana and A. filifolia (sand sagebrush) (Miller *et al*. in press, p. 7).

Comment [acn39]: Revise using new guidance for plants.

Current Range Distribution-PLACEHOLDER

Annual Lek Counts/Surveys-PLACEHOLDER

Management Zone Discussion/Description

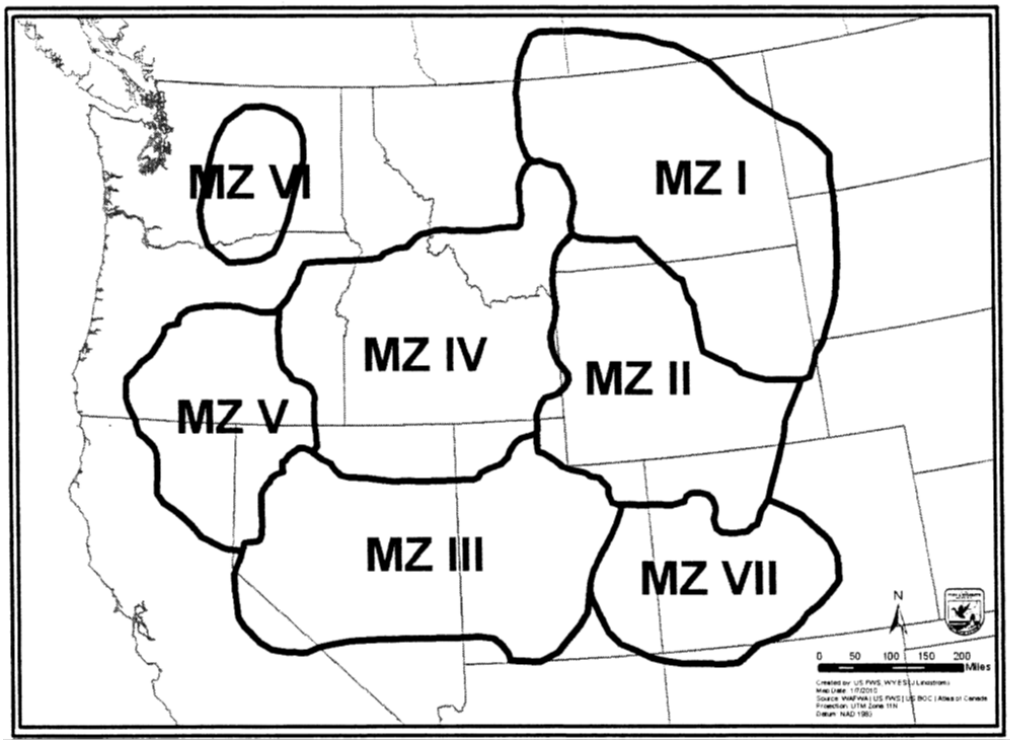
Due to differences in the ecology of sagebrush across the range of the greater sage-grouse, the Western Association of Fish and Wildlife Agencies (WAFWA) delineated seven Management Zones (MZs I-VII) based primarily on floristic provinces (Figure 2; Table 1; Stiver *et al*. 2006, p. 1-6). The boundaries of these MZs were delineated based on their ecological and biological attributes rather than on arbitrary political boundaries (Stiver *et al*. 2006, p. 1-6). Therefore, vegetation found within a MZ is similar and sage-grouse and their habitats within these areas are likely to respond similarly to environmental factors and management actions. The WAFWA conservation strategy includes the Gunnison sage-grouse, and the boundary for MZ VII includes its range (Stiver *et al*. 2006, pp. 1-1, 1-8), which does not overlap with the range of the greater sage-grouse.

Table 3-1: The Management Zones of the greater sage-grouse as defined by Stiver et al. 2006, pp. 1-7, 1-11.

MZ	STATES AND PROVINCES INCLUDED	FLORISTIC REGION
I	MT, WY, ND, SD, SK, AL	Great Plains
II	ID, WY, UT, CO	Wyoming Basin
III	UT, NV, CA	Southern Great Basin
IV	ID, UT, NV, OR	Snake River Plain
V	OR, CA, NV	Northern Great Basin

MZ	STATES AND PROVINCES INCLUDED	FLORISTIC REGION
VI	WA	Columbia Basin
VII	CO, UT	Colorado Plateau

Figure 2—The Management Zones for sage-grouse as identified by Stiver *et al.* (2006, p. 1-11). (Delineation primarily based on floristic provinces and population boundaries.)



PLACEHOLDER MAP—NEED NEW MAP FROM JIM

PLACEHOLDER FOR FIGURES BELOW AS PER REVISED OUTLINE

[Figure – WAFWA MZs, populations, and range map]

[Figure – PACs map]

[Figure – Strongholds map]

[Figure - Distribution models by MZ]

[Table - Numbers from Distribution models by MZ]

[Figure – Abundance models by MZ]

[Table - Numbers from Abundance models by MZ]

Chapter 4: **Land Ownership and Management – PLACEHOLDER (Jesse D'Elia) -** Summary (2-3 pages) of Ownership, and types of decisions and management actions (regulatory mechanisms) that are associated with each agency/owner

- [Figure - Land Ownership status by MZ]
- [Table – Land Ownership status by MZ]

- Federal Plans
  - USFS/BLM
    - LUP Amendments / Planning efforts
      - Disturbance Monitoring
      - Adaptive Management
      - Mitigation
      - FIAT
  - FWS/Refuges
  - NPS
  - DOD/DOE
- Tribal Lands and Plans
- State Plans
- Private Lands
  - FWS CCAA
  - NRCS SGI